





## Rathenau Instituut

### Mission

The Rathenau Instituut aims to encourage public debate and assist political decision-making in the area of science and technology. To this end, the Institute studies the organization and development of science systems, publishes on the social impact of new technologies, and organizes debates on issues and dilemmas in science and technology.

### The Rathenau Instituut

The Rathenau Instituut was founded in 1986 by the Netherlands Ministry of Education, Culture and Science. The institute conducts its work independently and impartially. It is funded by the Ministry of Education, Culture and Science, with responsibility for governance resting with the Royal Netherlands Academy of Arts and Sciences (KNAW).

### Who was Rathenau?

The Rathenau Instituut is named after Professor G.W. Rathenau (1911-1989), who was, successively, a professor of experimental physics at the University of Amsterdam, director of the Philips Physics Laboratory in Eindhoven, and a member of the Scientific Council for Government Policy. He achieved national renown as the chairman of the commission formed in 1978 to investigate the societal implications of micro-electronics. One of the commission's recommendations was that there should be ongoing and systematic monitoring of the societal significance of all advances in technology. Rathenau's work led to the foundation of the Netherlands Organization for Technology Assessment (NOTA) in 1986. On 2 June 1994, the organization was renamed 'the Rathenau Instituut' in his honour.

## FOREWORD

### From the chairman

2010 was my last year as chairman of the Rathenau Instituut. I had reached the maximum term of office and the articles of association required me to step down. This left me with something of an empty feeling.

When I took office as chairman seven years ago, the Rathenau Instituut was a small organization with a solid reputation in the field of Technology Assessment. This small institute was given a new remit: Science System Assessment. SciSA meant conducting research into the organization and functioning of the science system. Much has been achieved in both these areas: in 2010, the Rathenau Instituut was mentioned by the press hundreds of times, we published 15 opinion pieces and we were mentioned 15 times in parliamentary papers and in parliamentary questions. All of this regard for our work shows that the Rathenau Instituut is engaged in high-profile research and that we are a major player in the public debate on science and technology.

We installed a programme council in 2010, an important development in our history. The seven members of the council have all made their mark in politics, science and industry, and they will take a fresh look at our work programme. Remarkably, when they were asked to join the programme council, they all agreed immediately. That really says something about the pivotal role of the Rathenau Instituut.

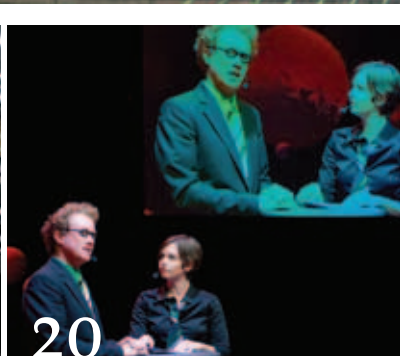
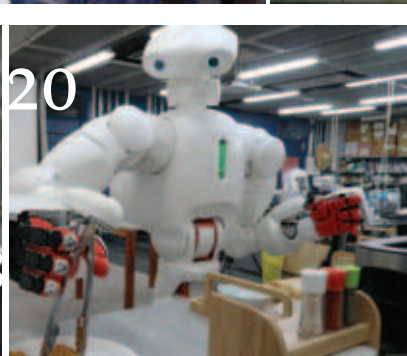
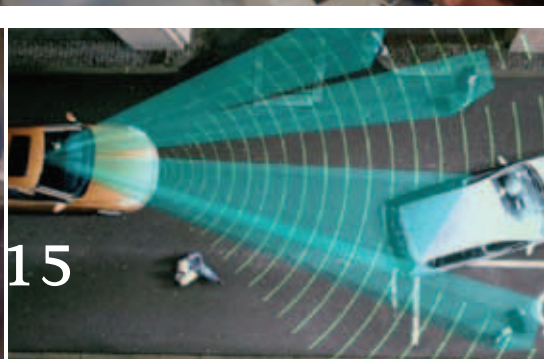
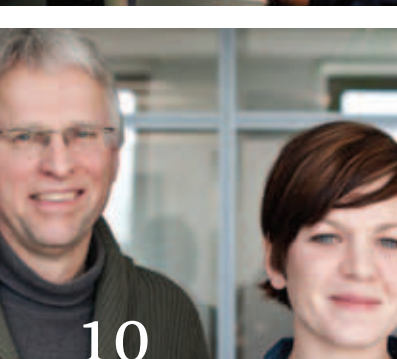
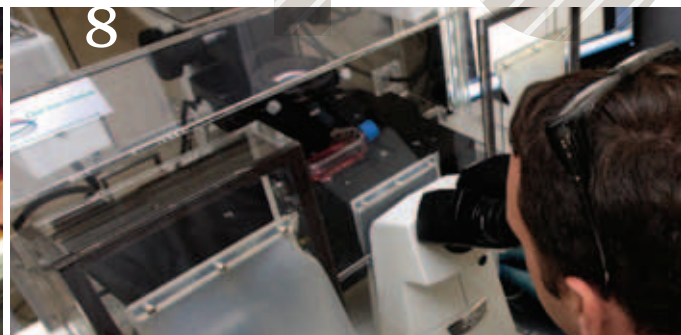
During my years as chairman, the Rathenau Instituut was very adept at moving with the times. The emphasis we placed on issues of medical ethics was a genuine acknowledgement, in my opinion, of certain concerns in society. These days there is some societal debate surrounding the usefulness and value of science. The Rathenau Instituut acknowledges this fact. I see an opportunity here for us to take advantage of our independent position and act as a bridge between the public and the scientific establishment. It is exactly this kind of responsiveness, which has been demonstrated by the institute time and again, that gives me every confidence that the Rathenau Instituut will continue to make a difference.

But I should add that my successor still has plenty of work to do. The target audience for each theme needs to be clearly defined again and again. We must look beyond the politically charged world of 'The Hague'. On the other hand, simply saying that our target audience consists of 'Dutch people' is not specific enough. We must also make sure that our recommendations are relevant to the target audience and that there is a real prospect of action and results. This will also help to ensure the institute's continued relevance.

*Wim van Velzen*



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The ERiC Guide



Dutch areas of emphasis are lagging behind from an international perspective



# Science System Assess

The Rathenau Instituut’s Science System Assessment (SciSA) department conducts research into the science system. How is it organized and how does it function? And how does it respond to developments in politics, the economy, society and in science itself? The answers to these questions can be used to develop policies that more closely reflect actual trends and issues.

## Improved method for assessing the social value of research

In 2010, the Rathenau Institute and a number of partners developed a method for assessing the societal value of scientific research.

Assessing the scientific quality of researchers might appear to be a simple matter. Count their publications, and the researcher with the highest tally wins. End of story. But doesn’t research have societal value, too? Doesn’t research help encourage innovation, improve health care, reinforce welfare and promote education? Yes, it does. These benefits can be mapped out using the guide developed as part of the ERiC project (Evaluating Research in Context) by the Rathenau Instituut in collaboration with the Royal Netherlands Academy of Arts and Sciences (KNAW), the Association of Universities in the Netherlands (VSNU), the Netherlands Organisation for Scientific Research (NWO) and the Netherlands Association of Universities of Applied Sciences (HBO-raad).

The guide was published in March 2010. Its core message is that you should ensure your institute’s

mission and goals are well defined from the outset. Then you should identify indicators that can be used to assess the extent to which these goals have been achieved. This principle was used to gain experience in architecture and other fields. “There are few scientific journals in the field of architecture,” said Leonie van Drooge of the Rathenau Instituut. “But there are plenty of architectural designs, websites, models and exhibitions. These are used by academic peers and practitioners.” Assessing these types of output is not as simple as counting publications, according to Van Drooge. “But it is far more indicative of the product of your research: this really is about its application and how much it is appreciated, both among fellow researchers and by practitioners.”

There have been many requests for the guide and it has been used in a number of assessments.

## ‘Focus and mass’ policy not working

Being a small country, the Netherlands is insufficiently equipped to excel in all areas



Research often has value for society



Valorization: from science to application. But how?



# ment

of scientific endeavour. Funding has therefore been concentrated in a limited number of areas that are considered vital to the economy, society or science.

Has this ‘focus and mass policy’ led to greater scientific output in these specific areas? No, concludes Edwin Horlings, who conducted research into this question together with Peter van den Besselaar. “Areas that received additional funding did produce more scientific publications. But the share of these specific focus areas within the entire Dutch scientific community did not grow. These areas are also lagging behind from an international perspective. This is because other countries are much more active in them, especially in Asia.

That is not to say that research money is being wasted. “On the contrary, that money makes a lot of great things possible. It’s just that once universities and research centres have redistributed the funds, it often ends up being used in a way that the government did not originally

intend.” The government could manage scientists better by stipulating that funds may only be used for certain pre-defined research projects. However, this goes against the basic principles of autonomous science. “Maybe we should abandon our top-down approach to managing scientists,” says Horlings. “Because it doesn’t seem to be working.”

The research conducted by Horlings and Van den Besselaar has been presented to the Innovation Platform, the Research Policy Department of the Ministry of Education, Culture and Science (OCW) and the Young Academy.

## ‘Valorization as a learning process’ workshop

Suppose that a researcher makes a great discovery. Will that discovery make its way [>]



“The Rathenau Instituut helped us to map out the societal relevance of our research. Our identity and qualities are now more clearly defined than ever. Mapping out our societal relevance was of great benefit to us during our recent accreditation.”

Frank van der Hoeven, research director at the TU Delft Faculty of Architecture



The value of science needs to become apparent again



Scientists often fail to promote the practical application of their discoveries by jumping back into the rat race too quickly



[<] into the community? And if so, by what route? This is the central theme of the 'Valorization as a learning process' workshop organized by the Rathenau Instituut in 2010. There were participants from the Netherlands Organisation for Scientific Research (NWO), the STW Technology Foundation, the Innovation Platform and several government ministries.

"Scientific knowledge often has a long road to travel before it can be put to practical use," said Stefan de Jong of the Rathenau Instituut. "For example, a scientist writes a computer program which a more practically-oriented researcher uses

for some specific project. That researcher sends the program to a colleague at a university hospital, and the colleague shares the program with a radiologist. Ultimately, the radiologist uses the software to analyse brain scans faster." A good result - but one that requires playing the detective to trace the entire path. De Jong feels that this should happen more often. "As a scientist you need to demonstrate the value of your work to society. And if you know who is using your findings, you might want to offer them some assistance."

Scientists would then also need to be assessed based on the practical application of their findings

The road travelled by scientific knowledge on its way to practical application need not always be a long one





CERN: large-scale research facility



'The funding debate must not be allowed to delay investments. Science does not stand still'

and the support they offer, and not only on the number of publications. "After publishing a new finding, scientists generally jump back into the rat race too soon in their search for new research projects. This is understandable from the perspective of the scientist, but society might benefit from a bit more follow-up."

## A single particle accelerator or a herd of PhD students?

What is the economic, societal and scientific impact of large-scale research facilities such as particle accelerators, research reactors, wind tunnels and radio telescopes? That is the big question for Edwin Horlings of the Rathenau Instituut.

"According to prevailing opinion, large-scale facilities stimulate innovation and serve to attract and retain talented researchers. These facilities are also presumed to be hubs where many promising social networks arise that lead to breakthroughs in science." There is no proof for any

of these benefits, however, according to research conducted by Horlings in 2010. "We found no evidence suggesting that these facilities attract and retain talent. And we found only scant evidence for innovations resulting from new social networks." A number of interesting social networks have developed at CERN and some innovations have emerged. "But CERN is no ordinary research facility, of course."

In 2011, Horlings examined a number of large-scale research facilities very closely. "We need to have a debate about how we should be investing in these facilities." That kind of money doesn't grow on trees, after all. "You can make a multi-million-euro investment in technology, but you could also use the money to hire dozens of PhD students. The choice you make will have an effect on that particular field of research."

The debate on the allocation of funds should not lead to any delay in investment, says Horlings. "If you are absolutely sure that you want to build a large-scale facility, then you should do it, because science does not stand still. If you wait five years, you'll just be running ten years behind further down the road."



**'The Rathenau Instituut produces critical analyses like this one on investments in large-scale research facilities. This provides real insight into the way science functions, and provides us with the opportunity to enhance the effectiveness of science policy even further.'**

Frank Zuijdam, consultant at Technopolis



## Managing research

In 2010, the Rathenau Instituut presented the results of research into how research groups are managed and how they perform. The conclusions were accepted by researchers at five university medical centres.

### 'Ministry for Innovation is a worthwhile challenge'

We want the Science System Assessment projects to fan the flames of debate on science policy. That is exactly what we achieved in 2010 with Evaluating Research in Context – a method to assess the societal value of scientific research – and with a project on careers in science. The latter project demonstrated that academic careers are highly dependent on coincidence and chance. By conducting this kind of research, the Rathenau Instituut plays an important role in the debate on science policy.

Furthermore, cooperation with the Rathenau Instituut's department of Technology Assessment is becoming increasingly prominent. This can be seen in the new work programme, in which activities are no longer separated. Biosecurity was one of the first projects on which both departments worked in tandem. In this area, we see that issues related to the regulation of new technologies have a direct impact on the way research is conducted. The TA project 'Making Perfect Life' shows that biosecurity regulation is still in its infancy. We see more examples like this in converging technologies, a topic in the new work programme.

Finally, the new Dutch government has provided us with an interesting challenge by establishing a Ministry of Economic Affairs, Agriculture and Innovation. Science can result in innovation, after all, but this is not easy. Innovation requires organization - and just how do you go about organizing for innovation? What does this mean for universities, for research institutes outside the universities and for research happening at universities of applied sciences? What is the relationship between science and innovation policy? This is an exciting area of research that we will seek to get to grips with in 2011.

True or false? An excellent research group in the medical sciences consists of no more than ten people. True or false? A good lead researcher should be present in the lab every day. Inge van der Weijden asked researchers and policy officers at five university medical centres to respond to statements like these.

Van der Weijden and her team visited the five medical centres to present their research on how research groups function best. The main conclusion from their study, published in 2009 as a Rathenau report (0913), is that excellent research groups include up to fifteen people. "As the number rises beyond fifteen, you see diminishing returns: the number of publications per researcher actually falls."

Furthermore, the best research groups are led by researchers who have a thorough grounding in practice. "Someone who is engaged in research themselves, someone who is aware of the latest developments in the field and who is able to inspire their fellow researchers. They will also have a wide network, and will know how to acquire funding for research. They are not simply a manager who is not conversant with the research being conducted; someone like that would not make a good lead researcher."

The researchers at the five medical centres recognized many of these results. Following the lectures, they discussed the lessons that can be learned from this study. One of the conclusions is that university medical



# groups: out onto the shop floor

centres need to encourage more young researchers to think about leadership. Van der Weijden: “People need to start considering the possibility of becoming an academic leader early in their careers. What kinds of hoops will you have to jump through? Will you be able to do it? Do you want to do it? Good preparation results in better leaders.”

Furthermore, future leaders need to be encouraged to think about the benefits that science can bring to society. “They will need to do this more and more, both at the behest of government and in the service of society. They will need to provide answers.”

Van der Weijden has noticed tremendous interest in the subject of

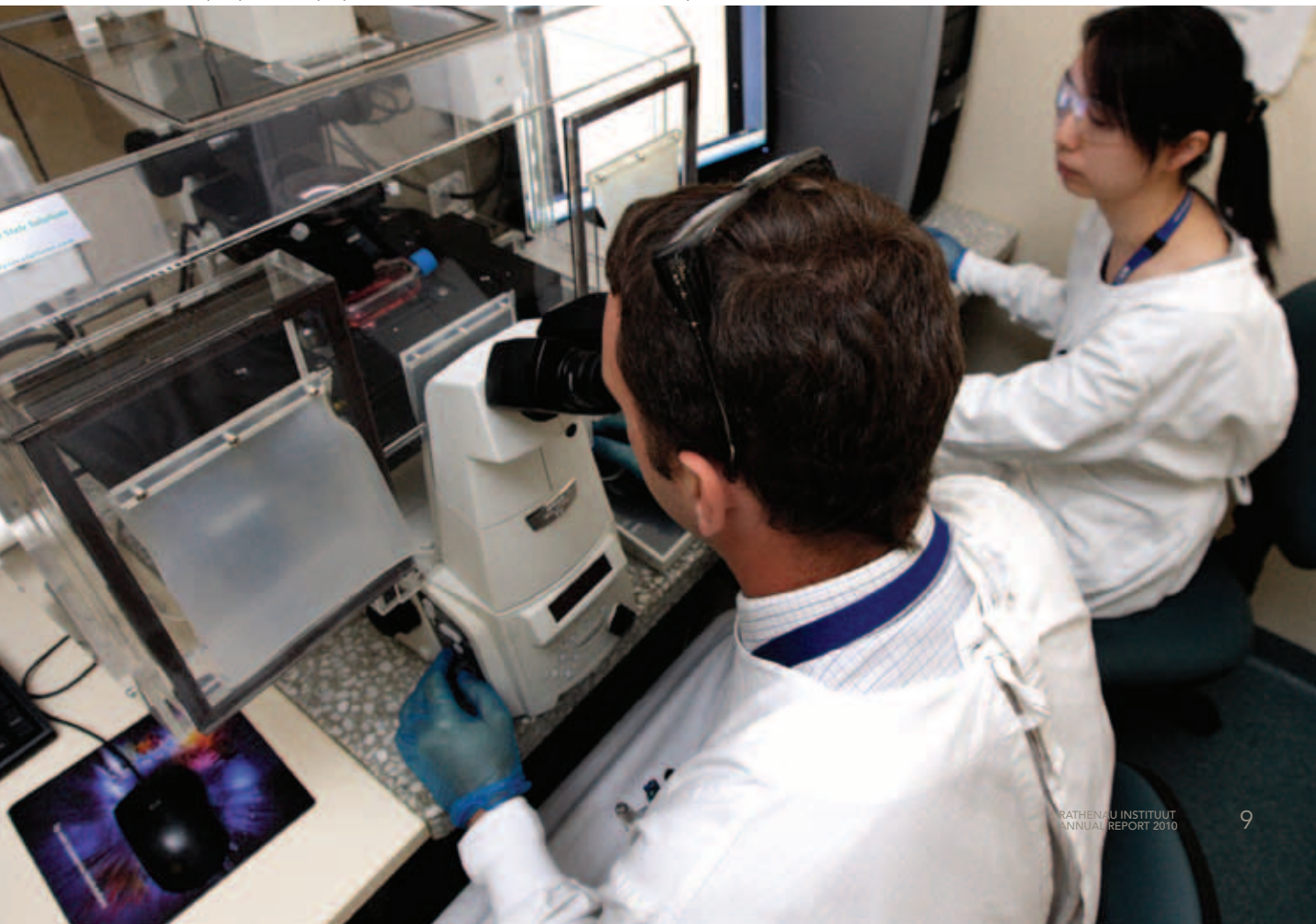
‘academic leadership’. In addition to her visits to the university medical centres, she and her team also gave a lecture to ZonMw policy staff, she organized a ‘track’ at the annual conference of the European Association for the Study of Science and Technology and she presented the research at the international workshop on Leadership and creativity in Goteborg, Sweden. She has also written articles for two Dutch magazines.

In the autumn of 2010, Van der Weijden and her team circulated a new questionnaire to determine whether academic leadership influences scientists’ motivation and performance. They also interviewed young researchers about their academic motivation and ambition. “The idea is that passionate

academic leaders provide the best possible working environment for their researchers and that this ideal working environment is conducive to improving their performance, leading to more publications. But is that really the case? I am very curious to find out.”

‘People need to start considering the possibility of becoming an academic leader early in their careers.’

Excellent research groups: up to fifteen people and a lead researcher who is firmly grounded in practice



How do you ensure that terrorists do not gain access to scientific knowledge and tools that might allow them to produce biological weapons? And what impact could security measures have on science? These are the big questions for Dirk Stemerding and Keelie Murdock.

# Terrorists can learn from



Dirk Stemerding and Keelie Murdock ask some critical questions about the balance between science and security



# science too

Science is becoming ever more interesting to terrorists. New inventions in areas such as genetic engineering and synthetic biology can bring huge benefits for society. But how do you prevent terrorists from exploiting this kind of scientific knowledge?

Issues like these – which are collectively known as ‘biosecurity’ – are high on the international agenda. The Netherlands is leading the way by developing a scientific code of conduct for biosecurity. Canadian researcher Keelie Murdock, who works at the Rathenau Instituut, is pleased with developments like this. But there is also a downside to this kind of diligence. As security measures become ever stricter, they can begin to hamper scientific freedom. “Who will get to decide which research projects can be carried out, and by whom? Who will be in charge of deciding which employees are allowed to work on a study? And what about sharing research results internationally – who will decide whether that can be done? These are critical questions for the science system, and this is exactly what we are interested in at the Science System Assessment department.”

Murdock works closely with Dirk Stermerding of the Technology Assessment department at the Rathenau Instituut. He looks at biosecurity from the perspective of the public debate on the new field of synthetic biology. “Tools are being developed in this field that are making it easier and easier to imbue life forms with new characteristics. What kinds of security measures are being put into place in actual practice? And who is responsible for these measures? Keelie Murdock and I looking at the puzzle from as many different perspectives as possible to try to find answers.”

In 2010 Murdock and Stermerding organized a joint workshop on biosecurity and synthetic biology for policy makers, scientists and organizations. Murdock: “We brought together individuals from

different worlds to give us a better understanding of the role and views of various parties in the field of biosecurity.”

Murdock and Stermerding have good news for the short term. In science, there is still a reasonable balance between security measures and the freedom to carry out research. And in any case, knowledge in the field of synthetic biology has not yet advanced to the stage where truly dangerous organisms can be created. “Today’s terrorist is limited to using naturally occurring compounds or organisms, because it’s just not yet possible to create new, hazardous life forms,” says Stermerding.

‘Knowledge in the field of synthetic biology has not yet advanced to the stage where dangerous organisms can be created’

But the pace of progress is ever increasing, and new dangers could emerge. Furthermore, synthetic biology is developing not only as a field of the life sciences, but also within other scientific disciplines such as nanotechnology and molecular chemistry. Even IT is involved in synthetic biology. Murdock and Stermerding: “Lots of people are working on genetic modification. Many have not been trained in the culture of the biological sciences, which has an established tradition of biosecurity. How can we go about introducing the concept of biosecurity into those disciplines? And what will this mean for science in these fields? These are the questions that need to be answered now.”

# 2010 in figures

More figures can be found in the appendices that are available on our website: [www.rathenau.nl/jaarverslag2010](http://www.rathenau.nl/jaarverslag2010)

Finances			Staff	
Budget allocation			On 31 December 2010	By department
<b>Revenue</b>	<b>Realisatie 2010</b> x € 1.000	<b>Begroting 2010</b> x € 1.000		
OCW Contribution	4.763	4.710		
Project revenue	536	570		
Other sources	45	36		
<b>Total revenues</b>	<b>5.344</b>	<b>5.316</b>		
<b>Expenditure</b>	<b>Realisatie 2010</b> x € 1.000	<b>Begroting 2010</b> x € 1.000		
Staffing costs	3.549	3.702		
Project costs	1.121	1.487		
Material costs	596	717		
<b>Total costs</b>	<b>5.266</b>	<b>5.906</b>		

Men 39%  
Women 61%  
total 54

Management & Support\* 10  
TA 16  
Communications 7  
SciSA 21  
total 54

Inflow 8  
Outflow 7

+ 3 seconded, 4 guest employees, 5 interns, 3 student assistants and 2 trainees

\* Management & Support also works for the Huygens Institute and for DANS (Data Archiving and Networked Services)

In the press		In politics	
<b>Press</b>			
Opinion pieces	15		
Television interviews	6		
Radio interviews	21		
Other print media (online and offline, including scientific articles)	248		
<b>Total</b>	<b>290</b>		

Parliamentary questions 3  
Parliamentary papers 12  
total 15

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# Testing the waters

The members of the newly appointed programme council of the Rathenau Instituut have convened for the first time. Wise men and women, all genuinely involved, who will be giving serious thought to the 2011-2012 work programme. There is a twinkle in their eyes. They see opportunities for the institute, because they see plenty of areas where society has managed to manoeuvre itself into a dead-end in the past year. Here is a summary of their deliberations.

**Agriculture and nutrition.** An open debate on the state of intensive agriculture in the Netherlands has barely got off the ground. In the meantime, Q fever has become an epidemic.

**Mobility.** The controversial road-pricing scheme for motorized traffic was not introduced in 2010. The morning rush hour seems to merge almost seamlessly into the evening rush hour these days.

**Energy.** People in the Netherlands are squabbling over ways to meet future energy needs. Meanwhile, protests against underground CO<sub>2</sub> storage in Barendregt have become so intense that the national government has been forced to back down.

**Innovation.** Scientists are instructed to conduct research that is both outstanding and that produces innovations that benefit society. The current system of science puts them between a rock and a hard place when it comes to satisfying both these demands.

But there's more: major IT projects are slow to get off the ground. Vaccination programmes intended to improve public health have ended in failure. Cameras which are there for public safety actually end up infringing the right to privacy. The programme council sees all these as symptoms of the fact that the old, established systems for managing social issues are reaching the end of their useful life. Our institute has a role to play here, according to the council, which challenged us to take "a broad approach" to our mandate. "Technology and science play a crucial role in all these matters, but the solution will not be of a purely technological nature. So carry out some exploratory drilling. Continue to produce independent analyses. Be critical and address the issues at hand with unremitting zeal and fervour. Then strive for synergistic unions, tackle painful issues and set out guidelines."

This will be an important task for our institute – ensuring that there is an informed debate on the problems facing society. A debate, furthermore, in which the right parties come forward to participate. I personally am terrified by the prospect of a society in which citizens respond to social problems either with a shrug of utter indifference or with fits of enraged anger. I am convinced that we can achieve better results through healthy, open debate than from all the knowledge of scientists, engineers and policy makers put together.

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The Rathenau Instituut's programme council meets several times per year. The council discusses new developments and the institute's research programme. The council was established by the Board of the Rathenau Instituut. The current members of the council are: Dr Ellen de Brabander, Prof. Marc Chavannes, Wim Deetman, Sander Dekker, Prof. Wim van de Donk, Marijke Vos and Jan Staman (secretary).





Living room for ICT Delta appreciated



EPD hearing in Parliament: weighty discussions on citizens' rights vis-à-vis databases



# Technology Assessment

The Rathenau Instituut's Department of Technology Assessment (TA) uses independent and impartial research to stimulate public debate and assist political decision-making on the societal, ethical and political consequences of science and technology.

## Time for reflection during ICT Delta

Databases are everywhere. Which ones hold information about you? And who can access them? This was one of the themes explored by the Rathenau Instituut at ICT Delta, an annual event for everyone involved in research in the computer sciences that was held in March 2010.

The Rathenau Instituut also ran the 'Ethics' section of the programme. "This year the 'IT direction' steering group, which was established to promote innovation in the IT sector, wanted to focus on ethics and society," says Christian van 't Hof of the Rathenau Instituut. "That's why they naturally decided to approach us."

The institute organized eight sessions on topics including the 'digital rights' of IT users, IT in science and IT in health care. Their stand was set up like a real living room. "At an IT conference, stands are always filled with computer screens," says Van 't Hof. "The Rathenau Instituut wanted to create a place for reflection – so we had a living room instead. People really noticed it, and we heard many appreciative comments." Visitors

to the stand were invited to use a laptop to vote on the hypothetical question of which fields of research they thought should receive a share of one hundred million euro of public grants. We announced the results at the end of the day in the session on 'the value of science'.

The outcome was surprising, according to André Somers of the Rathenau Instituut. This is because those attending the IT conference did not vote to allocate all the money to computer science research. They also chose to apportion millions in research grants for environmental sciences and social sciences. "Those working in IT are clearly sensitive to far-reaching contemporary issues such as climate change and social unrest relating to integration."

## Whiter clouds for a better climate

Can we combat global warming with geo-engineering? Is it feasible? Can we afford it? And above all, is it safe? The Rathenau Instituut held a debate on this subject in 2010, jointly with the Universiteit van Amsterdam.



Geo-engineering: Using algae to reduce atmospheric CO<sub>2</sub>



In 2010 the Rathenau Instituut organized a debate with the Universiteit van Amsterdam on the subject of geoengineering



“We could fertilize the oceans in order to make algae absorb more CO<sub>2</sub>,” says Monique Riphagen of the Rathenau Instituut. “Or we could put mirrors in space to prevent sunlight from reaching the earth. Another idea is to use salt to make clouds whiter, increasing their reflective properties so that more sunlight is bounced back into space.”

Any form of geoengineering will have advantages and disadvantages. “Climate change is a global issue, so the whole world needs to be involved. How can you get all those countries to work together effectively on the problem? Fertilizing the oceans would be a major intervention in a number of ecosystems. We could end up making a terrible mistake.” The debate on these issues is still in the scientific phase, Riphagen said. It will eventually have to move into the mainstream. “Scientists tend to devise and present cut-and-dried solutions without reference to others involved, but you really need to get civil society involved at an early stage. If you make sure everyone has their say, there will be stronger support further down the line. Otherwise people will just dig in and refuse to compromise.”

In 2011 the Rathenau Instituut will continue to track the main issues in the debate on geoengineering and identify ways to initiate dialogue between scientists and civil society.

## Rave reviews for ‘Mars Landing’

Amazing! The first humans walk on Mars! At least they do in the play ‘Mars Landing’, which toured the Netherlands in late 2010, visiting six cities.

The play was created by theatre director Andrea Bozic for Theater Frascati and the Rathenau Instituut. “We wanted people to experience for themselves how the boundaries between the virtual and the real world are shifting,” says Chantal Steegers of the Rathenau Instituut. “Events in games like World of Warcraft and Habbo Hotel, a game for kids, can have repercussions in the ‘real’ world. There have been cases of virtual furniture theft in Habbo Hotel, >]



“The Rathenau Instituut organized two expert meetings on the electronic patient record for the upper house of the Dutch parliament. These meetings have helped us to verify the information we receive from other sources such as the Ministry of Health, Welfare and Sport”

Ing Yoe Tan, member of the upper house of parliament for the Dutch Labour Party (PvdA)



Mars landing – a play in which the real and virtual worlds converge



Making Life Perfect – lessons on human enhancement in the European Parliament



The brains of Parkinson's sufferers can be electrically stimulated so that their hands shake less

## ‘Significant questions arise where brain science and IT converge. These have yet to receive the attention they deserve’

[<] for example. The furniture’s owner had paid real money for it. What is virtual and what is real? What is ‘reality’, in fact?” This was the big question that the audience was confronted with. Images of real space missions were shown during the play along with specially recorded scenes from the space station simulator at Space Expo in the town of Noordwijk.

Each performance ended with a debate between experts from the gaming industry, politics, science and media on the limits and rules of virtual reality. According to Steegers, such a debate could serve as a good preparation for a future trip to Mars, if we ever actually get there. “Who will set the rules on the Red Planet? Whoever is there first? Or some government? But which one? In fact, these are the same questions that are hotly debated in games and virtual worlds.”

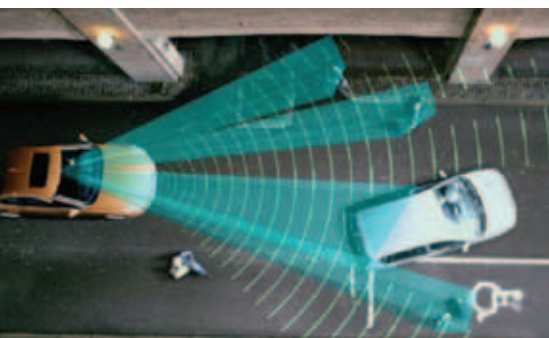
### Biology is becoming engineering – and vice versa

What does a car with automatic brakes have to do with electronic brain stimulation? A great deal, according to Rinie van Est of the Rathenau Instituut, because each is an example of the current convergence of engineering and biology.

As part of the Making Perfect Life project, the European Parliament asked van Est to chart the convergence of nanoscience, life science, information technology and brain science. He showed that these fields have already converged to quite a considerable extent. “We are creating ever more accurate models of living systems such as cells. Thanks to nanotechnology, we are already able to intervene in living systems with greater ease. The brains of Parkinson’s sufferers can be electrically stimulated so that their hands shake less, for example, and we can build smart cars that can brake automatically while travelling at under 30 km/hour if a child suddenly crosses the road.” The conclusion, which was presented to the European Parliament in 2010, is that biology is becoming engineering, and vice versa.

This development raises many ethical questions, of which many people are still unaware. “There is a tremendous emphasis on ethics in the life sciences. Just consider the use of stem cells, for example,” says van Est. “However, significant questions arise when brain science and IT converge, for example. These have yet to receive the attention they deserve.” That is something that needs to change. “Suppose the artificial intelligence in a car is a system that can learn. The system’s responses will then change over time. Who becomes responsible when something goes wrong: the manufacturer, the artificial intelligence or the motorist?”





Smart cars that can brake automatically if a child suddenly crosses the street are already being built



Genetic engineering: not necessarily a bad thing

## 'Genetic engineering and agriculture can be made to work in harmony'

Just imagine that the world's population continues to grow and the planet is beset by widespread food shortages. All the traditional methods used to boost food production (such as the use of artificial fertilizers) have already been deployed. Genetically engineered crops could boost yields, but the citizens of Europe will have nothing of it. Food shortages become a fact of life. This causes the price of some foodstuffs to skyrocket, putting them out of reach of large groups of consumers. What would we do next?

This is the worst-case scenario for agriculture as described by Dirk Stemerding of the Rathenau Institute and Ruth Mampuy of COGEM (GM commission). In fact, many politicians and policymakers are worried that this scenario could

become reality. They feel that the only solution is for European citizens to embrace genetically engineered foods. Their message is that Europe is not an island. 'We need to get on board.'

Stemerding and Mampuy also explore other potential scenarios, however. Their report even includes a 'best-case' scenario, where there is no food shortage at all. A more realistic scenario is that of 'European individuality'. In this scenario, Europe closes its borders to GM food, but worldwide GM food production is sufficient to feed all the hungry mouths outside Europe.

"These are nothing more than possible future scenarios," Stemerding is keen to emphasize. "They are not predictions. They just show that the collision course is not the only option open to us. In Europe, genetic engineering is not the only option. We have a choice. We will be bringing this to the attention of politicians and policymakers in 2011."

Report: 'Global motivation or European individuality: four scenarios for GM crops in European agriculture'.



**'The Rathenau Instituut is usually able to formulate an astute assessment of current issues in science and technology, bringing together a range of disciplines, from philosophy to empirical research'**

Arthur Petersen,  
chief scientist at the Netherlands Environmental Assessment Agency



# 'We are already

Anyone walking or driving down a street these days leaves traces. Electronic traces, anyway.

## Design for debate

We are always on the look-out for new ways of communicating so that we can publicize the results of our projects and promote public debate. The Rathenau Instituut does not just rely on reports. We also work with specially designed, interactive books and magazines. In 2010 we were even involved in the production of a play. This variety of approaches helps to bring to life the themes we focus on. If a picture is worth a thousand words, then an experience is worth a thousand pictures.

We gave the director full theatrical freedom for the play 'Mars Landing'. It turned into a wonderful piece about a virtual (or was it real?) landing on Mars. And in our publication 'Check in / Check out' on the digitization of public space, we printed tags that led readers to a website. We have also had a map designed that shows the spread of nanotechnology, helping to make a complicated theme more readily accessible for everyone.

The goal of these new means of communication, which go far beyond trusted yet old-fashioned slide shows and lectures, is to help people to make judgments, of course. They need to help policymakers and society as a whole to think and reach conclusions. That is the Rathenau Instituut's goal, after all. We speak of 'design for debate'. I think we have already taken a very interesting step.

We are going to apply this principle to other projects in 2011, and I expect some great results.

Your route can be monitored electronically on the basis on the location of your mobile phone relative to communication masts. The GPS system in your car keeps track of your location every second. A Google Street View car snaps a picture of you, and CCTV cameras in city centres record images that are stored on a database. Banks know when and where you have withdrawn money from an ATM (and how much, of course). Your public transport chip card records your journeys by public transport, your start point and destination.

These practices – and their consequences – are the central theme in the book 'Check in / Check out', published by the Rathenau Instituut in 2010 together with NAI Publishers. "We no longer just surf the internet," says Christian van 't Hof of the Rathenau Instituut. "We are already living our lives on the internet, at least as far as our digital identity is concerned."

On the one hand this is a positive development: digitization provides much more user convenience in the form of services. Digitization makes travel easier, and going out at night safer. On the other hand, citizens' privacy needs to be safeguarded. The book deals with a number of principles that should be applied to the digitization of public spaces. For example, citizens should be able to change or remove any false or inaccurate information from their electronic profile.

Furthermore, information should be anonymous, except where that might hamper the authorities' efforts to combat crime. "You don't want the police to be able to see where you are driving at any given moment: you should be an anonymous electronic dot on their map. But when that dot starts racing at 220 km per hour through a residential

# living inside the net'

area, 'inside the net', many people feel that anonymity should be surrendered."

Design sessions were held before the book was written. These sessions gave policymakers and citizens the chance to devise applications for a 'living map': a map showing people's locations in real time. "That's a good way to get people to think about the digitization of public space," says Van 't Hof. "Some of those applications are already a reality, though they've come about for different reasons. There are dating services that let you view available men and women within a radius of a few hundred meters of your present location, for example."

There have been many positive reactions to the book, albeit from unexpected sources. "We thought the book would be very popular

among those who administer public space, such as municipalities," says Van 't Hof. "But we've had hundreds of orders for the book from the IT sector, and I receive invitations to give lectures every week. "IT professionals are happy that they now have a complete picture of a trend that is affecting us all." The police and security sector have also shown considerable interest.

The book also features tags which readers can scan using their smart phones. The tags direct the phone's internal browser to a website containing information and a discussion on the topic. "The physical world and the virtual world are converging," according to Van 't Hof. "We thought that this would be a nice way to demonstrate what we mean."

The book does not conclude that

the digitization of public space is, in itself, good or bad. However, it does entail risks which we need to consider. The book ends with twelve design principles in support of this. Companies and organizations that design digital systems for public spaces can analyse their designs using these principles. "They then need to decide who may access the digital information, when they are permitted to do so and under what circumstances," explains Van 't Hof.

“There are risks associated with the digitization of public space that must be considered’

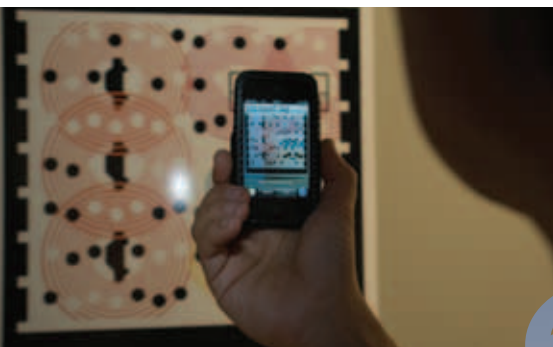
Digital systems in public space? Read the twelve design principles from Check In / Check out



# Argument for IT Authority draws attention



Deluge of complaints about public transport chip card



‘Fascinating and essential reading for policymakers and administrators’

Carien Overdijk in ‘Digital Management’, on the report ‘Check in / Check out’



Parliamentary questions concerning ban on fur farming



Use and storage of human tissue

The Rathenau Instituut always aims to stimulate public debate and facilitate the political evaluation of the effects of science and technology. This means that the institute is often mentioned in the media, in its many contemporary manifestations. In 2010, the institute was mentioned about 300 times in the press.

The report entitled ‘Databases – on IT promises, the hunger for information and digital autonomy’ attracted the most media of year. The report, which argues the case for an authority to supervise the design and functioning of databases, was featured in *de Telegraaf* and *Vrij Nederland*, among others. It was mentioned on almost thirty websites including the *Automatisering Gids*, *Vrij Nederland*, *Bright*, *Computable* and *Binnenlands Bestuur*. Director Jan Staman appeared as a guest on the morning *Ochtendspits* programme made by the broadcaster *Wakker Nederland*.

Other publications by the institute also received extensive coverage from various media channels – from the newspaper *NRC* (‘Universities must compete more’) to *Delta*, the newspaper of TU Delft (‘You, health robot’) and the *Agrarisch Dagblad* (‘Farmers must make better use of their key position’). The Rathenau Instituut was also mentioned in *het Reformatorisch Dagblad* (‘Politicians must find own climate answers’), *de Uitkrant Amsterdam* (about the play ‘Mars Landing’), *de Telegraaf* (‘Deluge of complaints about public transport chip card’) and the professional journal *Accountability in Research* (about robotics).

Staff members from the Rathenau Instituut were interviewed in the media almost thirty times in 2010. These included interviews with *de Volkskrant*, *Elsevier*, *Digitaal Bestuur*, *Quest*, *Het Parool*, *de Ingenieur* en *De Limburger*. They also appeared around thirty times in radio and television programmes, including *BNR Nieuwsradio*, the radio station *FunX*, *Teleac* and *Wakker Nederland*.

Rathenau Instituut staff members published fifteen opinion articles in 2010 including *het Financieële Dagblad* (biotechnology), *NRC Next* (the use of bodily materials), *EOS Magazine* (bodily materials) and the *European Journal of Migration and Law* (the electronic borders of Europe).

Finally, the Rathenau Instituut was mentioned fifteen times in parliamentary documents and parliamentary questions in connection with various parliamentary discussions and debates

# from press and politics

– for example about the law that criminalized fur farming and the Electronic Patient Dossier.

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## Robots in our midst

In 2010, researchers from the Rathenau Instituut began preparing the report entitled ‘Robots in our midst’, which was published in 2011. The report is a wide-ranging exploration of the social impact of the latest developments in robotics. The newest generation of robots are doing more than just the work that is too boring, heavy or dangerous for people to do. They are becoming part of our lives. They are helping the elderly, serving in restaurants and securing buildings. This is raising many social, ethical and legal issues. In 2010, the Rathenau Instituut was featured regularly in the press on this subject, including in *Filosofie Magazine*, *het Limburgs Dagblad* and *het AD*.

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## Fierce debate over the social value of research

In 2010, the Rathenau Instituut developed the ERiC method (Evaluating Research in Context) with its partners. This will help to chart the contribution of research to solving social problems and promoting innovation in the business community. The method led to many discussions, including on Vincent Icke’s *NRC Next* blog. ‘We actually risk shooting ourselves in the foot with this demand for utility-utility-utility,’ he wrote. ‘It’s absurd to insist that all scientific research must be useful.’ The researchers at the Rathenau Instituut agree with him on that point, incidentally. ‘But in our experience, many researchers actually want to show what their contribution is to innovation, public health, well-being or education,’ says Barend van der Meulen.

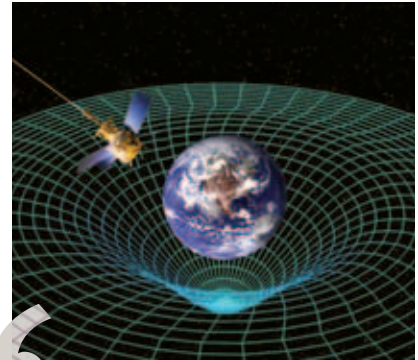
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## Eat less meat

Jan Staman, the director of the Rathenau Instituut, and philosopher Marjan Slob co-authored a strategic agenda for the ethical policy of the Ministry of Agriculture, Nature and Food Quality. The authors’ suggestion that the government should opt for a form of ‘gentle paternalism’ in order to make citizens eat more healthily and sustainably was taken up by parts of the media and led to some heated debate, including in *Trouw* and on *GeenStijl*.



Social robots provide care, serve and monitor



‘Your car’s satnav would not work were it not for Einstein’s theory of relativity’

Vincent Icke on the usefulness of science



‘The Rathenau Instituut has chosen an unconventional method to show that virtual worlds are becoming more real’

‘De Volkskrant’ science section on Mars Landing

Lively discussions about eating less meat





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## Flux magazine for friends of the institute

In June 2010, the first edition of *Flux* was published, the magazine for friends of the Rathenau Instituut. It was about the virtual world. The article '(Em)Power to the people', Christian van 't Hof of the Rathenau Instituut argues that citizens must be given greater say over the digital information that is available about them.

At the end of 2010, Flux turned its attention to the theme of the 'Crisis in Science?'. 'Scientists should avoid making sweeping, generalized promises to society', say researchers from the institute. 'They need a narrative that is based on truth, and should be financially rewarded for developing one.'

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You can request a free copy of many of our publications by sending an e-mail to [bestellingen@rathenau.nl](mailto:bestellingen@rathenau.nl).

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The complete Rathenau Instituut Annual Report 2010 is available on our website:

[www.rathenau.nl/jaarverslag 2010](http://www.rathenau.nl/jaarverslag%202010)

## PUBLISHING DETAILS

© Rathenau Instituut, The Hague 2011  
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**Editing**  
Rathenau Instituut

**Text**  
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**Published by**  
Rathenau Instituut

**Photos**  
Floren van Olden, Robert Jan Stokman, Loes Schleeidoorn (Check in / Check uit), Anna van Kooij (Mars Landing), Daniel Cortier (Making Perfect life), Philips newscentre (page 6), Alltech Pressbox (pp. 14/15), CERN (pp. 6/7), Hollandse Hoogte (pp. 4, 14, and 19), iStockphoto (page 11) and the internet

**Design and layout**  
Max Beinema Graphic Design, Millstatt

**Printing**  
Drukkerij Groen, Hoofddorp

**Translation**  
Taalcentrum-VU, Amsterdam

This annual report is printed on FSC certified paper

June 2011

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